REMARKS

This Amendment is responsive to the August 6, 2008 Office Action. Claims 1 and 3-6 stand rejected. Claims 1 and 5 have been amended. Support for the claim amendments may be found, for example, in the specification at page 29, lines 9-16 and page 33, lines 11-20. Claim 6 has been cancelled. Claims 1 and 3-5 are now pending in this application.

Claim Rejections under 35 U.S.C. §112, second paragraph

Claims 1 and 6 stand rejected under 35 U.S.C. §112, second paragraph for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention. In particular, the Examiner asserts that the term "at least one of" in claims 1 and 6 results in an improper Markush group. The subject matter of claim 6 has been incorporated into claim 5 and claim 6 has been cancelled. Applicants respectfully submit that the term "at least one of" is an acceptable alternative expression that does not create uncertainty or ambiguity rendering the claim indefinite.

Reconsideration and withdrawal of this rejection are respectfully requested.

Claim Rejections Under 35 U.S.C. §103(a)

Claims 1 and 3-6 stand rejected under 35 U.S.C. § 103(a) for obviousness over United States Patent No. 6,861,144 to Wakamatsu et al. in view of United States Patent No. 4,374,093 to Rollmann et al. In view of the foregoing amendments and the following comments, reconsideration of this rejection is respectfully requested.

Independent claim 1, as amended, recites, *inter alia*, "a longitudinally-extending wall with a space thereinside and heating means which heats the surface of the wall at a silicon deposition feasible temperature, wherein a silicon deposition feedstock gas inflow opening and a deposited silicon discharge opening are provided at an upper portion and a lower end portion respectively, and a plurality of flow resistance-increasing regions are provided on a wall surface of the tubular reaction vessel that is contacted with a feedstock gas, wherein the plurality of flow resistance-increasing regions are at least one of protrudent and concave regions."

Independent claim 5, as amended, recites, *inter alia*, "a longitudinally-extending wall with a space thereinside and heating means which heats the surface of the wall at a silicon deposition feasible temperature...and a flow resistance-increasing region is created on a wall surface of the tubular reaction vessel that is contacted with a feedstock gas, wherein the plurality of flow resistance-increasing regions are at least one of protrudent and concave regions; introducing a silicon deposition feedstock gas containing a chlorosilane through the silicon deposition feedstock gas inflow opening; and producing polycrystalline silicon from the chlorosilane-containing silicon deposition feedstock gas in the heated reaction vessel."

The combination of the Wakamatsu patent and the Rollmann patent fails to render independent claims 1 and 5 obvious.

The Wakamatsu patent discloses a tubular reaction vessel including a longitudinally-extending wall with a space thereinside, where the sectional area of part of the vessel may be larger than other parts of the vessel, as shown in Fig. 4, for improving the conversion of chlorosilane into silicon by extending the residence time of reaction gas.

In contrast, the present invention provides the reaction vessel internal wall with a flow resistance-increasing region and a heating means which heats the surface of the wall at a silicon deposition feasible temperature. Thus, not only can the <u>diffusion-blocking upward flow be diminished, but the feedstock gas in the vicinity of the reaction vessel central axis can also be effectively mixed with the upward flow</u>. Accordingly, the present invention is different from the extension of the residence time of reaction gas.

In the present invention, by providing the flow resistance-increasing region and the specific heating means, <u>the feedstock gas can be effectively contacted with the deposition surface at the silicon deposition feasible temperature</u> and silicon fine powder and the like can be re-contacted with the deposition surface and be incorporated in the deposit. Moreover, because the feedstock gas supplied is uniformly heated to the silicon deposition feasible temperature, the silane oligomer can be re-decomposed, and the by-products discharged from the reaction vessel can be dramatically reduced to accomplish higher silicon yields.

The Office Action at page 5 concedes that the Wakamatsu patent does not

disclose flow resistance-increasing regions as recited in independent claims 1 and 5, but relies upon the Rollmann patent to teach such a feature. In particular, the Examiner asserts that the internal baffles (17) located on the inside surface of the reactor in the Rollmann patent teach the flow resistance-increasing regions of the present invention.

The Rollmann patent discloses zeolite crystallization from a solution of silica, a solution of nitrogen-containing ions and a solution of alumina-containing ions. This reaction is conducted in an aqueous solution, namely a solution phase reaction, and is different from the reaction system of the present invention. Moreover, the heating means of Rollmann is clearly different from that of the present invention. The heating means of the present invention heats the surface of the wall. In particular, the heating temperature obtained by the heating means of the present invention is the silicon deposition feasible temperature, such as 1100 °C or more. Accordingly, the heating temperature of the present invention is significantly higher than the reaction temperature of Rollmann, which is not more than the boiling temperature of the solvent.

In the Rollmann patent, solutions are homogeneously mixed together and heated to produce crystalline zeolite. Therefore, in Rollmann, the combination of the baffles and rotating stirrer blade provides sufficient lifting action for the reactant (the solutions) and products (zeolite) to advance upwardly with sufficient turbulence for the reactants to assure proper residence time for the reaction to take place.

In the present invention, by providing the reaction vessel with a flow resistance-increasing region and the heating means which heats the surface of the wall at a silicon deposition feasible temperature, not only can the diffusion-blocking upward flow be effectively diminished but the feedstock gas in the vicinity of the reaction vessel central axis can also be effectively mixed with the upward flow. Moreover, the feedstock gas supplied can be uniformly heated to the silicon deposition feasible temperature.

Furthermore, the production of silicon in the present invention is a gas phase reaction and is distinguishable from the solution phase reaction of the Rollmann patent. In the solution phase reaction of Rollmann, the fluid motion is different from the gas phase reaction of the present invention. In the solution reaction, diffusion-blocking upward flow does not occur in zeolite production. Instead, the important consideration in the solution phase reaction of Rollman is mixing solutions with each other and assuring proper residence

time for the reaction.

On the contrary, in the gas phase reaction of silicon production, when a low-temperature feedstock gas is flowed downward into a reaction vessel whose wall (on which silicon will be deposited) has a high temperature, particularly 1200 °C or above, a strong flow occurs near the deposition surface in the opposite (upward) direction to the feedstock gas (downward). This phenomenon becomes more marked as the temperature difference between the wall and the gas increases. Consequently, the upward flow blocks diffusion of the feedstock gas to the deposition surface lowering the feedstock gas reaction efficiency, and accidental local gas turbulence brings part of the high-temperature upward flow into contact with part of the low-temperature feedstock gas, forming by-products. Moreover, the upward flow reduces the possibility that the formed by-products will be re-contacted with the deposition surface so that most of the by-products are discharged from the reaction vessel. This problem of the gas phase reaction at the silicon deposition feasible temperature, as described above, was first discovered by the Applicants. In the solution phase reaction of zeolite, the problem described above does not occur.

By providing the flow resistance-increasing region and the specific heating means, the <u>feedstock gas can be effectively contacted with the deposition surface at the silicon deposition feasible temperature</u>, thereby, silicon fine powder and the like can be re-contacted with the deposition surface and be incorporated in the deposit. Moreover, because the feedstock gas supplied is uniformly heated to the silicon deposition feasible temperature by the specific heating means, the silane oligomer can be re-decomposed, and the by-products discharged from the reaction vessel can be dramatically reduced to accomplish higher silicon yields. The Rollmann patent fails to teach or suggest these effects.

Therefore, for at least the foregoing reasons, one of ordinary skill in the art would not modify the apparatus or process of Wakamatsu with the baffles of Rollmann, which are used in a solution phase reaction for producing crystalline zeolite. The purpose, function, mechanism and advantages of a flow resistance-increasing region of the present invention are quite different from the baffles and rotating stirrer blade of Rollman. Further, the Rollmann patent fails to teach or suggest that the baffles and rotating stirrer blade are used for the production of silicon under the gas phase reaction and that the vessel comprises a heating means which heats the surface of the wall at a silicon deposition feasible temperature.

Accordingly, the combination of the Wakamatsu patent and the Rollmann patent fails to render independent claims 1 and 5 obvious.

Dependent claim 3 further recites "that each flow resistance-increasing region is a protrusion provided in the tubular reaction vessel, and an external wall of the reaction vessel is reduced in thickness in the protrusion-provided area." Contrary to the position asserted on pages 5 and 6 of the Office Action, Figs. 2 and 2A of the Rollmann patent fails to teach or suggest an external wall of the reaction vessel being reduced in thickness in the protrusion-provided area as required by dependent claim 3. Therefore, the combination of the Wakamatsu patent and the Rollmann patent fails to teach or suggest all of the limitations of claim 3.

Claims 3 and 4 also depend from and add further limitations to independent claim 1. Thus, claims 3 and 4 are deemed to be in condition for allowance for all of the reasons discussed above with respect to independent claim 1.

Reconsideration and withdrawal of this rejection is respectfully requested.

Conclusion

In view of the foregoing amendments and comments, Applicants respectfully request reconsideration of the rejections of claims 1 and 3-5 and allowance of the same.

Respectfully submitted,
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